ISSN: 0974-5823 Vol. 7 No. 4 April, 2022

International Journal of Mechanical Engineering

CONSTRUCTION PROJECT PLANNING AND ANALYSIS OF TIME ACCELERATION USING PRECEDENCE DIAGRAM METHOD (PDM)

S. Divya Bharathi

Assistant Professor, PG and Research Department of Mathematics, Theivanai Ammal College for Women (Autonomous), Villupuram 605602, Tamil Nadu, India.

R. Sivasankari

M.sc Mathematics, PG and Research Department of Mathematics, Theivanai Ammal College for Women (Autonomous), Villupuram 605602, Tamil Nadu, India.

Abstract: In the field of project management today, most projects face cost and time runs with increase the complexity of project involved. These studies present an analysis of precedence diagram method (PDM) in construction planning and scheduling. The building construction project was carried out according to the schedule at the time of the initial session's work. There was delay to start the work. And my aim is to find out the work time using Precedence Diagram Method (PDM) and accelerate a time by increasing man power. Based on the results of PDM the data obtained and analyzed. The results of normal duration of work with the PDM method produce 119 working days, due to addition of man power the results of the acceleration of the time done by the PDM method obtained 104 working days.

Keywords: Time acceleration, construction planning, (PDM).

1. Introduction

The problem faced by the building construction project is start 2 weeks late by some documentation issues. Initial planning for project is 119 working days. But at the time of implementation, there was an delay of 14 working days so, it was carried out 105 working days. To achieve the target, applies the PDM (Precedence Diagram Method) so that planning according to the contract and minimize the time to avoid occurring project delay. The analysis states, What is the duration of the work analyzed using PDM and based on the Critical Path, what is the duration of the possible time acceleration of a project. If the acceleration of the project duration can be done by increase in man power.

Precedence Diagram Method (PDM) is a best way of analyzing network activities when running a project to predict the total duration. It is a clear method of diagraming scheduling of project planning. In a PDM, project's critical path is a sequence of activities that determines the fastest time possible for a project to be completed. Some things to note about this critical path, Delayed work on the critical track will delay the completion of the overall project track. Completion of the project as a whole can be accelerated by accelerating completion of work -work on the Precedence diagram. It is easy to find the slack values in precedence diagram method. The precedence diagram slack work is equal to 0 (zero) which is critical path of the project scheduling. The complete work of project will be clearly diagramed in PDM (FIG 3).

The Precedence Diagram Method (PDM) is the preliminary step in planning of project. The entire project becomes more comfortable when you break down the tasks to perform the activities. A strategy of scheduling activities in a project plan and developing a project schedule network diagram that utilizes nodes to represent activities.

In the Precedence Diagram Method, we observe Earliest Start time(ES),Latest Start time(LS),Earliest Finish time(EF),Latest Finish time(LF),And slack which is equal to 0(zero) is denoted by an critical path of the project. The arrow denotes the dependencies on the activity ie., predecessor activity and successor activity.

2. Material and method

The precedence diagram method (PDM) is a tool for scheduling activities in a project plan. It is a method of constructing a project schedule network diagram that uses boxes, referred to as nodes, to represent activities and connects them with arrows that show the dependencies. It is also called the activity-on-node (AON) method.

The Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM) techniques are essentially limited to "finish-start" relationships (i.e., activity B cannot start until activity A is completed). PDM was developed subsequent to the PERT/CPM techniques and its function is to permit a more accurate depiction of relationships among various activities.

2.1 Precedence Diagram Method (PDM) Benefits

There is a lot of benefits that can be obtained by using the PDM. These are:

Highlights relationships and dependencies among activities to ensure planning efficiency.
Identifies possible missing activities.
Helps identify critical activities to ensure better planning.
Helps develop the overall project schedule.

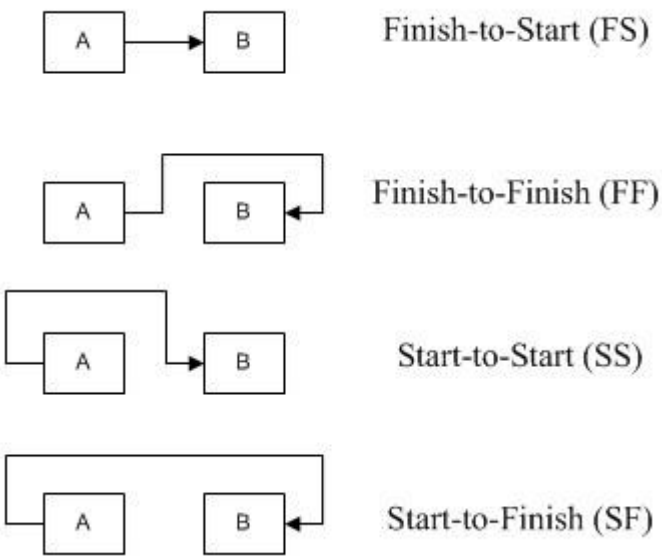

Figure 1.4 ways to develop PDM

Figure 2. elements in PDM

2.2 The Four Precedence Diagram Methods (PDM):

The PDM has four ways for developing the diagram. These methods are:

1) Finish-Start: In this dependency, an activity cannot start before a previous activity has ended. This is the most commonly used dependency.(Fig 1)
2) Start-Start: In this dependency, there is a defined relationship between the start of activities.(Fig 1)
3) Finish-Finish: In this dependency, there is a defined relationship between the end dates of activities.(Fig 1)
4) Start-Finish: In this dependency, there is a defined relationship between the start of one activity and the end date of a successor activity. This dependency is rarely used. (Fig 1)

2.3 Algorithm to calculate critical path:

Forward pass calculation:

Early Start (ES) represents the earliest start of an activity considering the dependency preceding task. If an activity is having more than one dependency predecessor, then ES will be the highest Early Finish (EF) of the dependency task.

Early Start = Maximum (or Highest) EF value from immediate Predecessor(s)

To calculate Early Finish, we use forward pass. Means moving from Early Start towards right to come up with Early Finish of the project.

Early Finish (EF) = ES + Duration

Backward pass calculation:

Latest Start (LS) is the latest date that the activity can finish without causing a delay to the project completion date.

To calculate Latest Start (LS), we apply backward Pass moving from Late Finish and deducting from activity duration.

LS = LF – Duration

Float calculation:

Finding the project duration is to identify the critical path and total float. Float represents how much each individual activity can be delayed without delaying successor activities or project completion date.

Total Float = LS – ES or LF – EF

Total Float shows the difference between the Latest Finish (LF) and Earliest Finish (EF)

3. Working and results

Estimated time for each activity is the time needed to complete each of these jobs using the PDM (precedence Diagram Method) network. For this building project uses several analyzes, namely determining the amount of time required as can be seen in Table.

No	job description	the activities	Duration(day)
1	preparatory work	A	7
2	maturation land work	B	21
3	soil work	C	14
4	Basic floor structure work	D	21
5	upper floor structure work	E	21
6	Roof work	F	7
7	Wall or plastering Work	G	28
8	Door and window work	H	21
9	ceiling work	I	20
10	Floor work	J	21
11	Painting wall work	K	14
12	Sanitation work	L	7
13	plumbing work	M	21
14	Electrical work	N	21
15	Building environment road work	O	14
16	Landscaping Road work	P	14
17	Side fence work	Q	14
18	Front fence work	R	14

The earliest time to finish an activity is the same as the earliest start time, plus the period of the activity in question. Forward count formula EF = ES + D. The result of the work duration with forwarding Calculation is 119 working days. Calculation formula backward The most recent start time of an activity is the same as the most recent completion time minus the time period for the activity concerned or LS = LF-D Network with forwarding and backward calculations for building projects in Precedence diagram method can be seen in (Fig 3) .

3.1 Speed up the duration

From the planning of activities to the estimated time discussed, it is known that the results of scheduling exceed the targets set by management, so it is necessary to accelerate in several activities. Based on the critical path of the results of the calculation, it is determined to accelerate several activities including activities (AB-DE-FNKL) which include preparatory work, land maturation work, ground floor structure work, top floor structure work, roof work, electrical work, work painting, and sanitation work. Due to

the accelerated time duration of 14 days, the acceleration method was chosen using the addition of manpower so that some of the accelerated activities included activities (A-B-K) which included preparatory work,

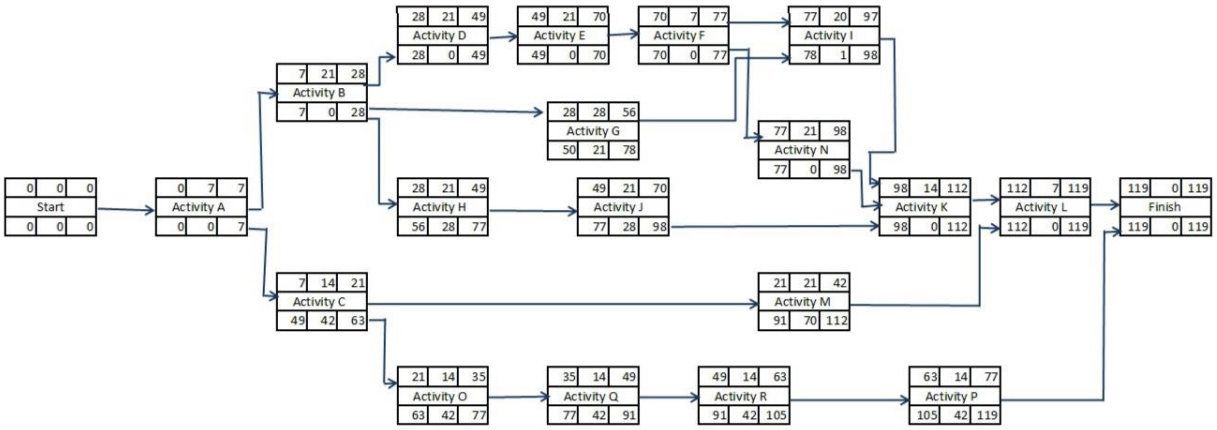

Figure 3.Precedence Diagram

land maturation work and painting work

3.**2 Activity A (Preparatory Work)** In preparatory work there are several sub-jobs to be carried out including the following:

a. Measurement of the situation again.
b. Demolition of existing barrier walls.
c. Field cleansing and leveling.
d. Building bow plank measurements and boards.
e. Water supply and work electricity.
f. Project nameplate.
g. Administration, Documentation and As-built drawing.

So there is an additional workforce included in activity A that is 3 workers,9 craftsmen,1 head manson,1 foreman. When the result of total accelerated duration is 4 days in an Activity A.

Activity B (Land Maturing Work)

In the land maturation work, there are several sub-jobs carried out, So there is an additional workforce included in activity B, that is 7 workers,4 craftsmen,1 head manson,1 foreman. When the result of total accelerated duration is 16 days in an Activity B.

Activity K (Painting Work)

In the Painting Work, there are several sub-jobs carried out, So there is an additional workforce included in activity K, that is 3 workers,9 manson,1 head manson,1 foreman. When the result of total accelerated duration is 7 days in an Activity K.

4. Conclusion

The result of Precedence diagram Method is 119 working days, equal as the planned duration. And with the acceleration of the duration carried out by the precedence diagram method using the addition of labor in activities (A-B-K) including preparatory work, land maturation work, and painting work so as to obtain final duration is 104 working days. In further analysis this work can be carried out in PERT (problem evaluation and review technique) also.

References

[1] Analysis of Time Acceleration Costs in Level Building Using Critical Path Method. Andrew Ghea Mahardika et al (2019.

[2] Y. Arslan, H. B. M. E., 2017. Planning and Monitoring of industrial punch development processes. Journal of Engineering Research and Applied Science, pp. 615-622.

[3] Taha, H. A. (1987). Operations Research: An introduction. London, United Kingdom: Collier MacMillan Publishers.

[4] Ervianto, W.I. (2004) Construction Project Management Application Theory, ANDI, Yogyakarta

[5] Frederika, A. (2010) Analysis of the Acceleration of Implementation by Adding Optimum Working Hours to Optimum in Construction Projects (Case Study: Super Villa Construction Project, Casket Tenget - Badung), Scientific Journal of Civil Engineering, vol.14, no. 2.

[6] Winston, W. L. (1993). Operations Research: Application and Algorithm (2nd ed.). Boston, MA: Kent Publishing.

[7] Zhong, D. H. and Zhang, J. S. (2003). New Method for Calculating Path Float in Program Evaluation and Review Technique (PERT). Journal of Construction Engineering and Management, 129, 501-506.

[8] Spatial Planning and Cipta Karya (2014) Main Tasks and Functions, Organizational Structure.